INDIAN SCHOOL AL WADI AL KABIR

ASSESSMENT II -2023-24

CLASS: XI **Sub: PHYSICS (042)** **MAX.MARKS: 70**

DATE: 05-12-2023 **Set -II** **TIME: 3 HOURS**

General Instructions

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each Case based question in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.

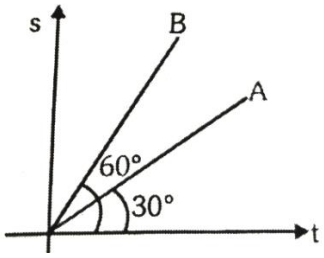
SECTION A (1 x 16 = 16)

1. The force acting on a body is denoted by $F= at+bt^2$, where t is time. The dimensions of a and b are respectively
   (a) MLT^{-2} and MLT
   (b) ML^2T and ML^2T
   (c) ML^2T^{-3} and MLT^0
   (d) MLT^{-3} and MLT^{-4}

2. 1 astronomical unit = ----------m
   (a) 1 AU = 1.496 x 10^{11}m.
   (b) 1 AU = 3.08 x 10^{11}m.
   (c) 1 AU = 1.496 x 10^{-11}m.
   (d) 1 AU = 3.08 x 10^{-11}m.

3. A bullet is dropped from a height and another bullet is fired horizontally from the same height. Then
   (a) dropped bullet will reach the ground first.
   (b) both the bullets reach the ground simultaneously
   (c) their motion depends on the observer
   (d) the bullet fired horizontally will reach the ground first.

4. Find the ratio of the velocity of A and B from the graph given below

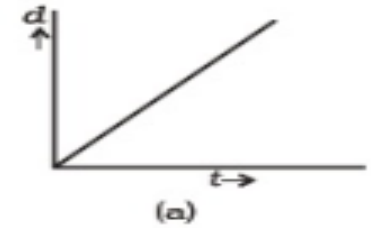


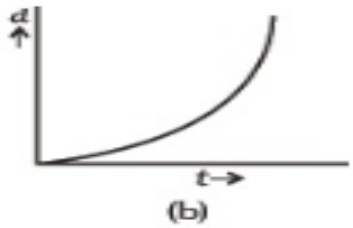
(a) $\sqrt{3}:1$
(b) $1:\sqrt{3}$
(c) $\sqrt{2}:1$
(d) 1: 3

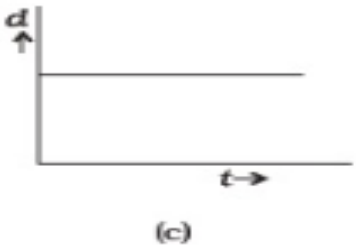
5. What is the angle between two vectors if the ratio of the magnitude of their dot product and the magnitude of cross product is $\sqrt{3}$?
   (a) 60°
   (b) 30°
   (c) 45°
   (d) 90°

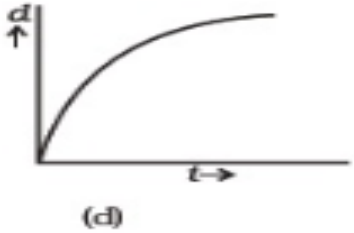
6. If the tension in the cable supporting an elevator is equal to the weight of the elevator, the elevator may be
   (a) Going up with uniform acceleration.
   (b) Going down with uniform acceleration.
   (c) Going up with uniform velocity.
   (d) Going up with non-uniform acceleration.

7. A body is moving unidirectionally under the influence of a source of constant power supplying energy. Which of the diagrams shown in figure correctly represent the displacement- time curve for its motion?









8. Two bodies of masses 1kg and 2 kg are located at (1,2) and (-1, 3) respectively. The coordinate of the centre of mass is

(a) $\frac{1}{3}$, $\frac{8}{3}$

(b) $\frac{-1}{3}$, $\frac{8}{3}$

(c) $\frac{1}{3}$, $-\frac{8}{3}$

(d) $-\frac{1}{3}$, $-\frac{8}{3}$

9 For a particle of a rotating rigid body, v = r ω, so

(a) $\omega \alpha \frac{1}{r}$

(b) ω α v

(c) v α r

(d) ω α r

10. The time period of a second's pendulum in a satellite is

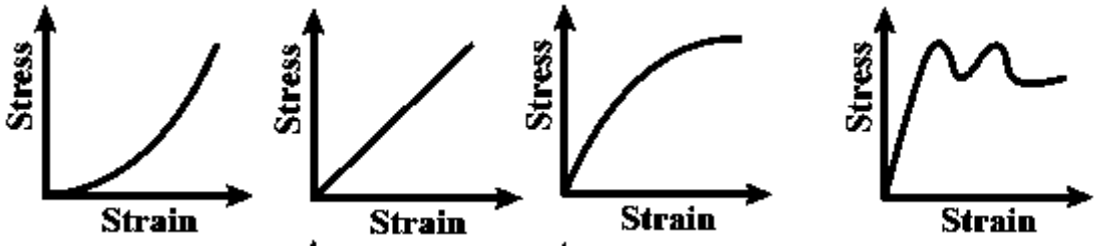
(a) Zero

(b) 2 seconds

(c) Infinity

(d) Depends on the mass of the body

11. Choose the correct stress- strain graph for elastomers.



(a) (b) (c) (d)

12. Rigidity modulus of steel is η and its Young's modulus is Y. A piece of steel of cross-sectional area a is stretched into a wire of length L and area a/10. Then

(a) Y increases and η decreases.

(b) Y and η remain the same.

(c) Y decreases and η increases.

(d) Y increases and η increases.

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
c) If Assertion is true but Reason is false.
d) If both Assertion and Reason are false.

13. **Assertion:** The average and instantaneous velocities have the same value in a uniform motion.
Reason: In uniform motion, the velocity of an object increases uniformly.
14. **Assertion:** The slope of momentum verses time curve represents the force.
Reason: According to Newton's second law of motion acceleration is given by the rate of change of momentum.
15. **Assertion:** Smaller the orbit of the planet around the sun, shorter is the time it takes to complete one revolution.
Reason: According to Kepler's third law of planetary motion, square of time period is proportional to cube of mean distance from sun.

16. **Assertion:** The bridges declared unsafe after a long use.
Reason: In the long run the amount of strain in the bridge for a given stress will become large.

SECTION-B (2 x 5 = 10)

17. A ball is kicked at an angle of 30° with the vertical. If the horizontal component of its velocity is 19.6m/s, find the maximum height.

OR

A ball is kicked at an angle of 30° with the vertical. If the horizontal component of its velocity is 19.6m/s, find the horizontal range.

18. Derive an expression for the potential energy of an elastic stretched spring.

19. Derive an expression for rotational kinetic energy of a rigid body.

20. What is gravitational potential energy at a point? How much work is done in lifting a mass m from the surface of the earth to a height equal to its radius?

21. Calculate the fractional compression $\frac{\Delta V}{V}$, of water at the bottom of the ocean having depth 3000m. The bulk modulus of water is 2.2×10^9 Nm^{-2}. (Take density of water as $1000kg/m^3$ and $g = 10\ m/s^2$.)

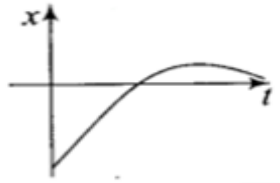
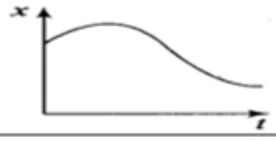
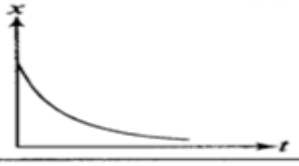
SECTION- C (3 x 7 = 21)

22. (a) Can a quantity have units, but still be dimensionless? Give an example.
(b) E, m, L and G denote energy, mass, angular momentum and gravitation constant respectively. Determine the dimensions of EL^2/m^5G^2.

OR

(a) Check the correctness of the equation p=hdg, where 'p' is the pressure at a point 'h' below the free surface of a liquid of density 'd' and g is the acceleration due to gravity.
(b) What are dimensional constants? Give one example.

23. Match the following and give reason for your answer.

Graph	Characteristics
(a) 	(i) has $v < 0$ and $a > 0$
(b) 	(ii) has a point with zero displacement for $t > 0$
(c) 	(iii) has $x > 0$ throughout and has a point with $v = 0$ and a point with $a = 0$

24. Read each statement below carefully and state with reason whether it is true or false.

(a) The net acceleration of a particle in circular motion is always along the radius of the circle towards the centre.
(b) The velocity vector of particle at a point is always along the tangent to the path of the particle at that point.
(c) The maximum height attained by the projectile is maximum when its horizontal range is maximum.

25. Which is easier, to pull a lawn roller or to push it? Explain with the help of a diagram.

26. A pendulum of mass 10^{-2} kg is raised to a height of 5×10^{-2} m and then released. At the bottom of its swing, it picks up a mass of 10^{-3} kg. To what height will the combined mass rise? Take $g = 10 m/s^2$.

27. (a) Find the percentage decrease in the weight of the body when taken to a height of 32 km above the surface of the earth. Radius of the earth is 6400 km.
(b) Where will the body weigh more, 1km above the surface of the earth or 1km below the surface of the earth? Give reason.

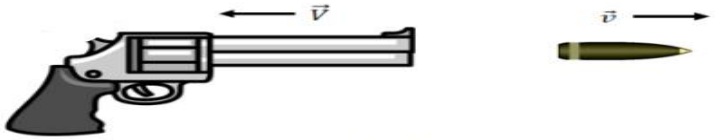
28. (a) A solid cylinder of mass 20kg rotates about its axis with angular speed 100rad/sec. The radius of the cylinder is 0.25m. What is the kinetic energy associated with the rotation of the cylinder? What is the magnitude of angular momentum of the cylinder about its axis?

SECTION- D (4 x 2 = 8)

29. Read the passage given below and answer the questions

According to the principle of linear momentum, in an isolated system, the vector sum of linear momenta of all the bodies of the system is conserved and is not affected due to their mutual action and reaction. **P** = constant.

Before firing



After firing

Based on this principle, we are able to explain the recoiling of a gun when a bullet is fired, flights of jet planes and rocket, Explosion on bomb etc. in all these cases if one part of system is moving in one direction then the other part move in such a direction that total linear momentum may remain constant.

(i) A gun weighing 10 kg fires a bullet of mass 30 g with a velocity of 330 m/s. with what velocity does the gun recoils?
(a) 9.9m/s
(b) -0.99m/s
(c) -9.9m/s
(d) 0.99m/s

(ii) A proton and an alpha particle are held at rest. Mass of alpha particle is four times the mass of proton and charge on it is twice the charge on proton. When they are released to move freely, alpha particle moves with velocity v then, the velocity of proton will be
(a) 2v (b) -2v (c) 4v (d) -4v

(iii) The momentum of a body of mass 200g with kinetic energy of 10 J is
(a) 3 kgm/s
(b) 2 kgm/s
(c) 0.2kgm/s
(d) 0.3 kgm/s

(iv) A bomb of mass m at rest explodes into two parts of masses m/3 and 2m/3 which move opposite to each other. If the velocity of lighter part is v then the velocity of heavier part is
(a) v/2 (b) -v/2 (c) v/3 d) -v/3

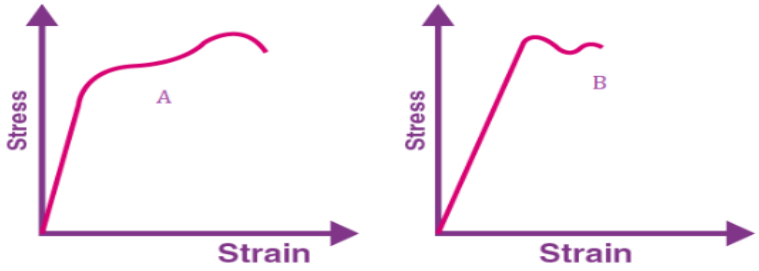
OR

(iv) A body of mass m collides against a wall with velocity v and rebounds with same speed. Its change of momentum is

(a) -2mv (b) mv (c) -mv (d) zero

30. Read the passage given below and answer the questions

The graph shown below shows qualitatively the relation between the stress and the strain as the deformation gradually increases for two materials A and B. Within Hooke's limit for a certain region stress and strain relation is linear. Beyond that up to a certain value of strain the body is still elastic and if deforming forces are removed the body recovers its original shape.



(i) Which of the materials has the greater Young's modulus?

(a) B, as the slope of the graph of B is less than that of A
(b) A, as the slope of the graph of B is less than that of A
(c) B, as the slope of the graph of A is less than that of B
(d) A, as the slope of the graph of A is less than that of B

(ii) The length of a suspended wire increases by 10^{-4} of its original length when a stress of 10^{7} N/m^2 is applied on it. The Young's modulus of the wire is

(a) 10^{10}N/m^2
(b) 10^{9}N/m^2
(c) 10^{-10}N/m^2
(d) 10^{11}N/m^2

(iii) The breaking stress for a wire of unit cross-section is called

(a) yield point
(b) elastic fatigue
(c) tensile strength
(d) Young's modulus

(iv) Which of the materials A or B is more brittle?

(a) A, as it has more plastic region
(b) B, as it has more plastic region
(c) A, as it has less plastic region
(d) B, as it has less plastic region

OR

(iv)Which of the materials A or B is more ductile?

(a) A, as it has more plastic region
(b) B, as it has more plastic region
(c) A, as it has less plastic region
(d) B, as it has less plastic region

SECTION E [5 x 3 = 15]

31. (a) Define elastic and inelastic collisions. Discuss the elastic collision in one-dimension. calculate the velocities of the bodies after the collision.

OR

(a) State the law of conservation of energy. Prove the law of conservation of energy by taking the example of a freely falling body. Draw the graph depicting variation of kinetic and potential energy with the height.

32. (a) State the law of conservation of angular momentum and prove it.
(b) Explain law of conservation of angular momentum by taking an example.
(c) A particle performing uniform circular motion has angular momentum L. If its angular velocity is doubled and its kinetic energy halved, then find the new angular momentum.

OR

(a) Define the term torque. Give its SI unit and dimensions.
(b) Derive a formula for torque with the help of a diagram.
(c) What is the angular velocity of the second hand of a clock? If the second hand is 10cm long find the linear velocity of its tip.

33. (a) Define acceleration due to gravity. Derive an expression for the acceleration due to gravity at a depth inside the surface of the earth.

(b) A body weighs 90kgf on the surface of the earth. How much it will weigh on the surface of the Mars whose mass is 1/9 and radius is ½ of that of the earth?

OR

(a) Define escape velocity. Derive an expression for the escape velocity of an object from the surface of the earth.

(b) The escape velocity on earth is 11.2 km/s. What will be its value on a planet having double the radius and eight times the mass of the earth?